REMARKS

Claims 1-37 were examined and rejected. Claims 38-48 have been previously canceled. Applicants amend claim 1 and 23 to correct obvious typographical errors. Applicants submit additional claims 49-50 for examination and submit that no new matter is added therein as those claims are supported at least by current claims 1, 31, 34 and 35. Applicants respectfully request reconsideration of claims 1-37 and consideration of additional claims 49 and 50 in view of at least the following remarks and the declaration pursuant to 37 CFR § 1.132 attached hereto admitting as evidence the expert opinion of Michael C. Green (herein "the attached declaration").

I. Claims Rejected Under 35 U.S.C. §102

The Patent Office rejects claims 1-2, 5, 16, and 27-29 under 35 U.S.C. §102(b) as being anticipated by U.S. Patent No. 6,403,965 issued to Ikeda, et al. ("Ikeda"). It is axiomatic that to be anticipated, every limitation of a claim must be disclosed within a single reference.

Applicants respectfully disagree with the rejection above of claim 1, for at least the reason that the cited reference does not disclose, teach or suggest a photodetector comprising a heterojunction formed of two semiconductor materials, being halides, wherein at least one of the first and second semiconductor materials consists of a semiconductor material, as required by claim 1. Claim 1, explicitly states the two semiconductor materials as being halides and forming a heterojunction; and that one of the two materials consists of a semiconductor material aside from impurities that might typically be present such as dopants.

Ikeda teaches selenium (Se) films 208, 209, 210, and 211 forming an x-ray image detector system (see Fig. 2; and col. 6, line 55 through col. 7, line 26). Ikeda teaches that Te or As may be added to the selenium (Se) to change resistivity (see col. 7, lines 9 - 13). Ikeda also teaches that the selenium (Se) films may be doped with Cl, I, Na, K, or P to change resistivity (see col. 7, line 13 - 26). Specifically, Ikeda column 7 lines 20-23 state

"Furthermore the n-type Se film 211 is formed so as to have a low resistivity by adding a large amount of a halogen such as Cl or I to Se to produce a large number of free electrons."

However, it is Applicant's position that doping Se with a halogen does not create a halide, but creates a semiconductor (Se) doped with a halogen. For instance, in Ikeda, the doped ions are not covalently bonded to the Se and thus, do not form a halide. Specifically, according to expert opinion, doping the amorphous selenium film of Ikeda, does not form covalent bonds between the halogen atoms and the selenium atoms, but instead incorporates the halogen atoms into the selenium lattice as dopants (see paragraph 10 of the attached declaration). For instance, in selenium doped with Cl, the chlorine is present as an interstitial impurity that acts like a semiconductor dopant and modifies the internal electronic energy levels, compensating for deep level photostructural defects that can act as traps, thereby increasing the mobility of electrons and holes in the amorphous selenium (see paragraph 12 of the attached declaration). Thus, doping amorphous selenium films with Cl or I does not form a halide as claimed, but instead is a known doping technique for amorphous selenium films.

Moreover, since too much dopant will degrade the performance of the selenium material, the phrase "a large amount of halogen" in Ikeda implies perhaps 50 ppm of Cl or I (see paragraph 11 of the attached declaration). Thus, the doped selenium will have halogen concentrations on the order of 10s of ppm. On the other hand, a halide compound has a particular stoichiometry because it is a covalent chemical compound (see paragraph 12 of the attached declaration). For instance, selenium halide chemical compounds such as Se_2Cl_2 and $SeCl_4$ have fixed selenium to chlorine atomic ratios of 1:1 and 1:4 respectively and contain a concentration of 500,000 ppm and 800,000 ppm iodine, respectively (see paragraph 12 of the attached declaration). Thus, selenium doped with Cl or I is not a halide as claimed because it is not a covalent halide chemical compound, and has tens of thousands times less halogen concentration than a halide.

Moreover, selenium halides clearly are not desired for forming heterojunctions due to their physical properties. For instance, the physical structure and the chemical identity of amorphous selenium (a black solid having the lattice structure of a glass) is retained in amorphous selenium semiconductor films when they are doped with chlorine or iodine (see paragraph 14 of the attached declaration). However, Se_2Cl_2 is an oily, pungent-smelling, liquid that freezes at -85 deg C; while $SeCl_4$ is a pale yellow, volatile, hygroscopic solid that is readily hydrolyzed by water (see paragraph 12 of the attached declaration). Also, although selenium bromides Se_2Br_2 and $SeBr_4$ exist, they are the physical structure analogs of the chlorides Se_2Cl_2 and $SeCl_4$ (see paragraph 12 of the attached declaration). Thus, selenium halide semiconductor materials do not have a physical structure that can be used to form a heterojunction as claimed.

Next, although selenium halide covalent chemical compounds Se_2Cl_2 $SeCl_4$, Se_2Br_2 and $SeBr_4$ exist (see paragraph 12 of the attached declaration), they are not semiconductors (see paragraph 13 of the attached declaration). Moreover, the analogous selenium halides with iodine are not known (see paragraph 12 of the attached declaration). Therefore, the formation of the compound selenium iodide is not even a chemical possibility (see paragraph 12 of the attached declaration). Thus, existing selenium halide semiconductor materials are not semiconductors as claimed.

On the other hand, without limitation thereto, PbI2 and HgI2 are examples of semiconductors that are halides. Representatively, without limitation thereto, mercuric iodide is a covalent chemical compound, which has precisely two atoms of iodine chemically combined with each atom of mercury and contains more than 66 atomic percent of iodide halogen (see paragraph 15 of the attached declaration). It has a specific crystalline structure, resulting from the directional covalent bonds between the mercury and iodine atoms, that is uniquely characteristic of the material and is intimately involved with the electron and hole transport properties of the halide semiconductor (see paragraph 15 of the attached declaration). Thus, without limitation

thereto, PbI2 and HgI2 are examples of semiconductors that are halides and can be used to form a heterojunction, as claimed.

In light of the attached declaration and argument above, it appears that the Examiner is relying on personal knowledge that a semiconductor such as Se doped with a halogen results in a semiconductor that is a halide. Applicant respectfully disagrees with this position and requests that the Patent Office submit an affidavit as to the foregoing pursuant to Rule 1.104(d)(2) to support the reliance above.

Consequently, the Patent Office has not identified and Applicants are unable to find any description in Ikeda that discloses, teaches or suggests a heterojunction of two semiconductor materials, being halides, and one of the materials consists of a semiconductor material, as required by claim 1. Hence, for at least the reasons above, Applicants respectfully request the Patent Office withdraw the rejection of claim 1 above.

Applicants submit that dependent claims 2, 5, 16, and 27-29, being dependent upon allowable base 1, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of dependent claims 2, 5, 16, and 27-29 as being unpatentable over the cited references.

In addition to the reasons above, Applicants disagree with the rejection of claim 16 for at least the reason that Ikeda does not disclose that the second semiconductor has a conductivity type different from the first semiconductor material, as required by claim 16. Specifically, Ikeda teaches that the first and second x-ray-to charge converting films (*e.g.*, films 209 and 210) are intrinsic, i-type semiconductors containing no intentionally doped impurities decreasing resistivity, or, i-type semiconductor films containing a small amount of impurity (see col. 4, lines 13-19). Thus, Ikeda does not disclose that the second semiconductor (*e.g.*, film 210) has a conductivity type different from the first semiconductor material (*e.g.*, films 209), as required by claim 16. Hence, for at least this

additional reason, Applicants respectfully request the Patent Office to withdraw the rejection above of claim 16.

II. Claims Rejected Under 35 U.S.C. § 103(a)

The Patent Office rejects claims 3-4, 7-15, 17-20, and 30-36 under 35 U.S.C. §103(a) as being unpatentable over Ikeda. To render a claim obvious, all elements of that claim must be taught or suggested by at least two properly combined references.

Applicants respectfully disagree with the rejection above and submit that dependent claims 3-4, 7-15, and 17-20, being dependent upon allowable base claim 1, are patentable over the cited references for at least the reasons explained above for claim 1. Thus, Applicants respectfully request that the Patent Office withdraw the rejection to dependent claims 3-4, 7-15, and 17-20 above.

Next, Applicants respectfully disagrees with the rejection above and submits that independent claim 30 is patentable over the cited reference for at least the reasons that the cited reference does not teach or suggest a first and second semiconductor material forming a heterojunction structure; a contact coupled to the second semiconductor material, wherein the first and second semiconductor materials comprise means for reducing a chemical reaction with the contact; and a means for reducing dark current in the heterojunction structure as required by claim 30.

The Patent Office points to material substitution to make the above noted limitations obvious. However, Applicants disagree as the teachings in Ikeda use a single type of semiconductor material to form all of the semiconductor layers of its image detectors. Specifically, he teachings in Ikeda use selenium (e.g., either i-type, n-type, or p-type selenium doped with Cl, I, Na, K, or P) as semiconductor materials (see col. 7, lines 9-26), or a similar structure using silicon instead of selenium (see col. 10, lines 60 through col. 11, line 47). However, the Patent Office has not identified and the Applicants have been unable to find any teaching or suggestion in Ikeda, that the materials forming any of the semiconductor layers is more corrosive or chemically

reactive to a contact than any other layer. Moreover, the Patent Office has not identified and the Applicants have been unable to find any motivation in Ikeda for protecting a contact from corrosion of any of the semiconductor layers. Hence, for at least the reason that Ikeda does not teach or suggest means for reducing a chemical reaction with the contact, Applicants respectfully request the Patent Office withdraw the rejection above of claim 30.

In addition, for claim 30, Applicants traverse that a means for reducing a chemical reaction with the contact and means for reducing dark current in the heterojunction structure (*e.g.*, such as described in Applicants' Specification), would be obvious to one in the art, and request the Patent Office cite a reference in support of that position in accordance with MPEP §2144.03. Hence, for at least this additional reason, Applicant respectfully requests the Patent Office withdraw the rejection above of claim 30.

In addition, the Patent Office has not provided a proper teaching from the references that doped selenium or any of the other materials noted in Ikeda are useful for the same purpose or equivalent to semiconductor materials comprising means for reducing a chemical reaction or means for reducing dark current in the heterojunction structure, as required by claim 30 (see MPEP § 2144.06). According to the Examiner's logic, publication of the design of the first photodetector in combination with material substitution, as broadly used by the Examiner in this case without citing any motivation in the reference for such substitution, would invalidate all subsequently filed photodetector patents. Hence, for at least these additional reasons, Applicants respectfully request the Patent Office withdraw the rejection above of claim 30.

Next, Applicants respectfully disagree with the rejection above and submit that independent claim 31 is patentable over the cited reference for at least the reason that the cited reference does not teach or suggest wherein the second semiconductor material is less corrosive than the first semiconductor material to the contact coupled to the second semiconductor material, as required by claim 31.

An argument analogous to the one above for claim 30 applies here as well. Specifically, the Patent Office again points to material substitution to make the above noted limitations obvious. However, there is no teaching or suggestion in Ikeda, and Applicant traverses the Patent Offices citation that the materials forming any of the semiconductor layers is more corrosive or chemically reactive to a contact than any other layer. Moreover, the Patent Office has not identified and the Applicants have been unable to find any motivation in Ikeda that a second semiconductor material is less corrosive than the first semiconductor material to the contact coupled to the second semiconductor material, as required by claim 31. Specifically, the Patent Office has not identified any indication that the doped selenium or other materials of Ikeda are useful for the same purpose or equivalent to a second semiconductor material that is less corrosive than a first semiconductor material to a contact, as required by claim 31 (see MPEP § 2144.06). Hence, for at least that reason, Applicants respectfully request the Patent Office withdraw the rejection above of claim 31.

In addition, for claim 31, Applicants traverse that a second semiconductor material is less corrosive than the first semiconductor material to the contact coupled to the second semiconductor material, as required by claim 31, and request the Patent Office cite a reference in support of that position in accordance with MPEP §2144.03. Hence, for at least these additional reasons, Applicants respectfully request the Patent Office withdraw the rejection above of claim 30.

Applicants submit that dependent claims 32-37, being dependent upon allowable base claims 30 and 31, are patentable over the cited references for at least the reasons explained above. Thus, Applicants respectfully request that the Patent Office withdraw the rejection of dependent claims 32-37 above.

In addition to the reasons above, Applicants disagree with the rejection of claim 32 for at least the reason that Ikeda does not teach that the first and second semiconductor materials are halides. The attached declaration and an argument analogous to the one above for claim 1 apply here as well. Hence, for at least this

additional reason, Applicants respectfully request the Patent Office to withdraw the rejection above of claim 32.

Next, for claims 3, 4, 14, 18, 20 and 34-36 Applicants traverse that the use of lead iodide for one of the semiconductor layers and mercuric iodide for another of the semiconductor layers is a mere substitution of art, and requests that the Patent Office cite a reference supporting the use of those two materials as the two layers, in accordance with MPEP §2144.03. Specifically, as noted above, Ikeda does not teach or suggest the use of different semiconductor materials as its conversion layers, but instead teaches the same base semiconductor material for all of the layers. Hence, for at least this additional reason, Applicants respectfully request the Patent Office withdraw the rejection above for those claims. In addition, Applicants assert that the Patent Office has not provided a proper basis that the doped selenium or other materials mentioned for Ikeda are useful for the same purpose or equivalent to those required by claims 3, 4, 14, 18, 20 and 34-36, as those claims require at least two iodide materials while column 12 lines 24-26 describe only one converting film. Hence, for at least this additional reason, Applicants respectfully request the Patent Office withdraw the rejection above of those claims.

In addition, Applicants respectfully traverse the Patent Office's assertion that the claimed band gaps of claim 17 are an inherent teaching of Ikeda, because of the material properties, and respectfully requests the Patent Office cite a reference in support of that position in accordance with MPEP §2144.03. For instance, the materials of Ikeda may have conductivities or have band gaps other than those claimed in claim 17. Hence, for at least this second reason, Applicants respectfully request that Patent Office withdraw the rejection above of dependent claim 17.

The Patent Office rejects claim 6 under 35 U.S.C. §103(a) as being unpatentable over Ikeda in view of U.S. Patent No. 6,353,229 issued to Polischuk, et al. ("Polischuk") or WO 20/67014 issued to Harel, et al. ("Harel").

Applicants submit that dependent claim 6 being dependent upon an allowable base claim, is patentable over the cited references for at least the reasons described above in support claim 1. Hence, for at least those reasons, Applicants respectfully request the Patent Office withdraw the rejection above of claim 6.

The Patent Office rejects claims 21-26 and 37 under 35 U.S.C. §103(a) as being unpatentable over Ikeda in view of U.S. Patent No. 6,949,750 issued to Tsutsui, et al. ("Tsutsui").

Applicants respectfully disagree for at least the reason that claims 21-26 and 37 depend upon allowable base claims 1 and 31, respectively. Thus, those claims are patentable over the cited references for at least the reasons explained above for their base claims. Hence, Applicants respectfully request the Patent Office withdraw the rejection above.

Moreover, for claims 21-23, 24-26, and 37, Applicants traverse that the use of lead iodide for one of the semiconductor layers and mercuric iodide for another of the semiconductor layers is a mere substitution of art, as noted above for claims 3 and 4, and requests that the Patent Office cite a reference supporting the use of those two materials as the two layers, in accordance with MPEP §2144.03. Specifically, as noted above for claims 3 and 4, Ikeda does not teach or suggest the use of different semiconductor materials as its conversion layers, but instead teaches the same base semiconductor material for all of the layers. Hence, for at least this additional reason, Applicants respectfully request the Patent Office withdraw the rejection above for claims 21-23, 24-26, and 37. In addition, Applicants assert that the Patent Office has not provided a proper basis that the doped selenium or other materials mentioned for Ikeda are useful for the same purpose or equivalent to those required by claims 22-26, as those claims require at least two iodide materials while column 12 lines 24-26 describe only one converting film. In addition Tsutsui fails to cure the shortcomings of Ikeda on this issue. Specifically, as noted by the Patent Office, Tsutsui also discloses a single photoconversion layer 4, but not dual layers, such as to form a heterojunction, as

claimed. Hence, for at least this additional reason, Applicants respectfully request the Patent Office withdraw the rejection above of claims 22-26.

CONCLUSION

In view of the foregoing, it is believed that all claims now are now in condition for allowance and such action is earnestly solicited at the earliest possible date. If there are any additional fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666.

Respectfully submitted,

BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN LLP

Dated: November 6, 2006

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